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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/829,161	04/09/2001	Salman Akram	3442.1US (96-428.1)	8260

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EXAMINER

NGUYEN, HA T

ART UNIT	PAPER NUMBER
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2812

DATE MAILED: 04/25/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/829,161

Applicant(s)

AKRAM, SALMAN

Examiner

Ha T. Nguyen

Art Unit

2812

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 05 March 2002.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-26 and 72-102 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-24 and 72-102 is/are rejected.
- 7) ☒ Claim(s) 25 and 26 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 09 April 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 2,3,4.

- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Claim Objections

1. Claims 1-26 and 72-102 are objected to because of the following informalities: in claim 1, line 4, after "metal" insertion of -- containing -- ; in claims 14 and 92, lines 2, substitution of the second occurrence of "the" with -- a --; in claims 72, 78, 79, 93, lines 3, 1 and 2, 2, 1, respectively, before "dielectric", insertion of -- first -- are suggested for clarity and correctness. Appropriate correction is required.

Claims 2-26 and 73-102 variously depend from claims 1 or 72 , they are objected to for the same reason.

Claim Rejections - 35 USC § 112

2. Claims 81 and 87 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 81 recites the limitation "the first metal layer" in line 2 and claim 87, the limitation "one edge" in line 1. There is insufficient antecedent basis for this limitation in the claim.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless --

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371⁶ of this title before the invention thereof by the applicant for patent.

4. Claims 1, 3, 5, 7-10, 14, 22, 72-74, 79, 80, 83-87, 92, and 100 are rejected under 35 U.S.C. 102(e) as being anticipated by Kim, U. S. Patent 6020233.

[Claims 1, 72-74, and 87] Referring to Figs. 3A-3C and related text, Kim discloses a method of fabricating a semiconductor device, comprising the steps of: forming a substantially planar first dielectric layer 205 on a substrate 201; forming at least one metal layer 210 or 220 over the first dielectric layer; forming a conducting layer 230 over the at least one metal layer; forming a second dielectric layer 250 over the conducting layer; removing aligned portions of the second dielectric layer, conducting layer, and at least one metal layer to form a multilayer structure (see Fig. 3A and col. 4, lines 58-64); and forming metal spacers 240 on sidewalls of the multilayer structure;

[Claims 3, 5, 79, and 80] wherein said forming the at least one metal layer comprises forming the at least one metal layer of Ti, Ta, W, Co or Mo or an alloy or a compound of any thereof, including TaN or TiN and wherein said forming the at least one metal layer comprises forming the at least one metal layer of titanium or titanium nitride (see par. bridging cols. 4 and 5);

[Claims 7, 8, 83, and 84] wherein said forming the conducting layer comprises forming the conducting layer from at least one of aluminum and copper; wherein said forming the conducting layer comprises forming the conducting layer of an aluminum-copper alloy (see col. 4, lines 1-6);

[Claims 9, 10, 85 and 86] wherein said forming the metal spacers comprises forming at least one layer of Ti, Ta, W, Co or Mo, or alloys thereof or compounds thereof, including TaN and TiN; wherein said forming the metal spacers comprises forming the metal spacers of titanium or titanium nitride (see col. 4, lines 7-17);

[Claims 14 and 92] further comprising forming the at least one metal layer and the metal spacers of a same metal (see col. 4, lines 1-17);

[Claims 22 and 100] wherein said forming the metal spacers comprises forming a metal spacer layer over the multilayer structure and first dielectric layer and removing portions thereof overlying the first and second dielectric layers (see Fig. 3B and col. 5, lines 14-23).

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103[©] and potential 35 U.S.C. 102(f) or (g) prior art under 35 U.S.C. 103(a).

6. Claims 2, 4, 6, 15-21, 23, 24, 78, 81, 82, 93-99, 101, and 102 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kim.

[Claims 2 and 78] Kim discloses substantially the limitations of claims 2 and 78, as shown above. But it does not disclose expressly wherein said forming the first dielectric layer comprises forming a silicon oxide or BPSG layer. However, the examiner takes Official Notice, BPSG is a planarizing dielectric commonly used in the art to achieve an easily made planarized dielectric layer of low dielectric constant.

[Claims 4 and 81] Kim also discloses further comprising forming a second metal layer 210 between a first metal layer of said at least one metal layer (in this case the at least one metal layer is 220) and the substrate, said second metal layer comprising a metal barrier film (see col. 3, lines 49-51). Kim also discloses that TiN/Ti is widely used as diffusion barrier (See col. 1, lines 38-39). But Kim does not disclose all the limitations in the same embodiment.

[Claims 6 and 82] Kim also discloses wherein the at least one metal layer is a single metal diffusion barrier layer 220, this is the case where layer 210 is of polysilicon. Kim also discloses that TiN/Ti is widely used as diffusion barrier (See col. 1, lines 38-39). But Kim does not disclose all the limitations in the same embodiment.

[Claims 15-18, and 93-96] Kim discloses wherein said forming the at least one metal layer comprises forming the at least one metal layer by vapor deposition ; wherein said forming

the at least one metal layer comprises forming the at least one metal layer by CVD, PVD or PECVD (see col. 7, lines 43-48). But Kim does not disclose the method for forming the conducting layer. However, it would have been obvious for a person of ordinary skill in the art to use the same method to deposit the at least one metal layer and the conducting layer to reduce the equipment requirements.

[Claims 19, 20, 75, 97, and 98] Kim discloses substantially the limitations of claims 19, 20, 97, and 98, as shown above. It also discloses that to form a conductive spacer, a conducting film is formed on the stack structure then anisotropic etching (see col. 6, lines 21-27). But Kim does not disclose wherein said forming the metal spacers comprises forming the metal spacers by vapor deposition as CVD, PVD or PECVD. However, it would have been obvious for a person of ordinary skill in the art to use a same method to deposit the at least one metal layer, the conducting layer, and the conducting film to reduce the equipment requirements.

[Claims 21 and 99] Kim also discloses wherein removing aligned portions of a stack of layers to form a multilayer structure by patterning and etching (see Figs. 3A and col. 6, lines 17-21). However, it does not disclose expressly that the stack of layers comprises the second dielectric layer, conducting layer, and at least one metal layer. However, it would have been obvious for a person of ordinary skill to use the patterning and etching on a stack comprising of desired layers suitable for a specific application.

[Claims 23, 24, 101, and 102] wherein said forming the metal spacers comprises forming the metal spacer layer over the multilayer structure and first dielectric layer and portions of the metal spacer layer over the multilayer structure and first dielectric layer are removed by etching (See col. 5, lines 14-23). However, it does not disclose expressly that the metal spacer layer is formed by a conformal deposition process. However, the examiner takes Official Notice that this is a conventional process of forming spacer.

A person of ordinary skill is motivated to modify Kim using well known process to obtain a device suitable for a desired quality and manufacturing cost.

Therefore, it would have been obvious to use Kim's teaching to obtain the invention as specified in claims 2, 4, 6, 15-21, 23, 24, 78, 81, 82, 93-99, 101, and 102.

7. Claims 1, 11-13, 72-74, and 88-91 are rejected under 35 U.S.C. 103(a) as being unpatentable over Liu et al., U. S. Patent 6277745 (Hereinafter Liu).

Referring to Figs. 2A-2F and related text, Liu discloses a method for making a metallization structure for a semiconductor device, comprising: forming a substantially planar first dielectric layer 2 (see col. 3, lines 31-35); forming at least one metal layer 4, 6 over the first dielectric layer; forming a conducting layer 8 over the at least one metal layer; forming a second dielectric layer 16 over the conducting layer; removing aligned portions of the second dielectric layer, conducting layer, and at least one metal layer to form a multilayer structure (see Fig. 2B); and forming metal spacers on sidewalls of the multilayer structure (see Fig. 2D); wherein said forming a second dielectric layer comprises forming the second dielectric layer on the conducting layer to have sidewalls aligned with sidewalls of the conducting layer (see Fig. 2B), and forming the metal spacers to extend along the sidewalls of the second dielectric layer (see Fig. 2D); further comprising forming the second dielectric layer of a low dielectric constant material (see col. 5, lines 1-5).

But it does not disclose expressly that the first dielectric layer is formed on a substrate and the second dielectric layer is of fluorine-doped silicon oxide.

However, the examiner takes Official Notice that it is well known in the art that a dielectric layer is formed on a substrate and that polyimide and fluorine-doped silicon oxide are low k alternatives used in the fabrication of a semiconductive device .

Therefore, it would have been obvious to use Liu' s teaching to obtain the invention as specified in claims 1, 11-13, 72-74, and 88-91.

Allowable Subject Matter

8. Claims 25, 26, 76, and 77 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims and overcoming the objection for informalities.

Claims 25 and 76 recite the features removing any remaining portion of the second dielectric layer and upper portions of the metal spacers laterally adjacent thereto.

These features in combination with the other elements of the claims are neither disclosed nor suggested by the prior art of record.

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Claims 26 and 77 depends from claim 25 or 76, they are allowed for the same reason.

Conclusion

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ha Nguyen whose telephone number is (703)308-2706 . The examiner can normally be reached on Monday-Friday from 8:30AM to 6:00PM, except the first Friday of each bi-week.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John Neibling, can be reached on (703) 308-3325. The fax phone number for this Group is (703) 308-7722.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 308-0956.



Ha Nguyen
Primary Examiner
04 - 19 - 02